

... an impurity implantation region of impurities of a second conductive-type formed in a first sector of the channel region, the first sector not reaching either one of the source region and the drain region, wherein the channel region exclusive of the first sector has a uniform doping concentration of the first conductive type;

[The above is repeated because, in paragraph 3 of the Office Action, the Examiner indicated that it was not understood which one was the novel element.]

Arguments made so far:

The Applicant repeats and incorporates by reference the prior made arguments. The Applicant respectfully traverses the Examiner's responses.

In addition, in view of the Examiner's responses, the Applicant has identified and separated the main issues. Their discussion below will shorten all other discussion, and answer all of the Examiner's new comments.

The main issues:

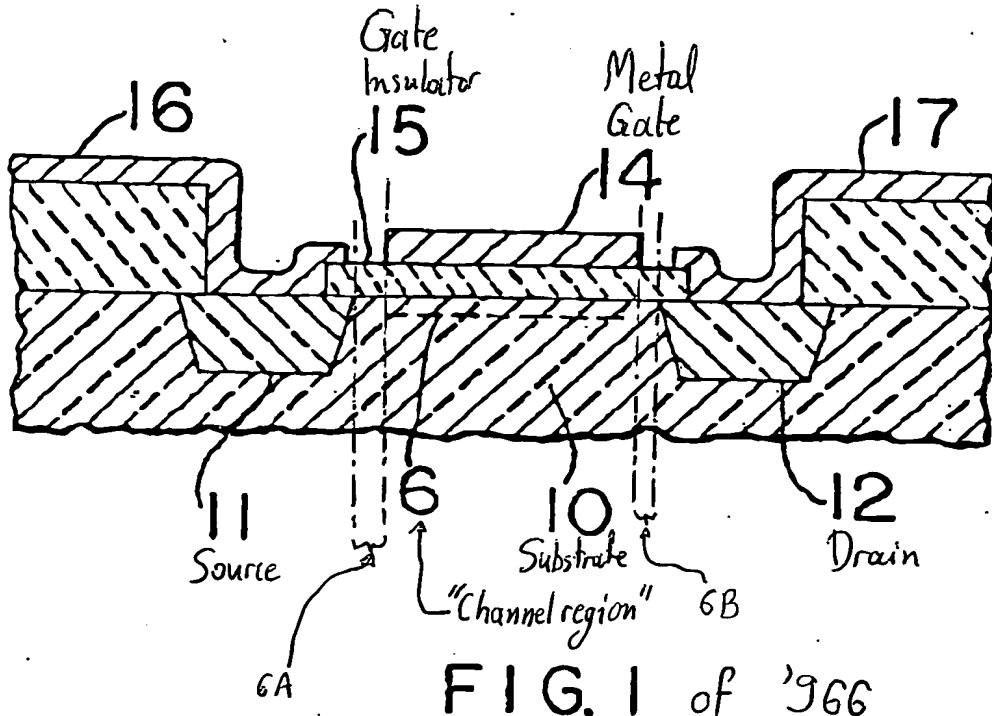
- A) The Applicant asserts that:
 - 1) Fig. 1 of the '966 patent is drawn imprecisely,
 - 2) Fig. 1 of the '966 patent does not show where its implantation occurs, and
 - 3) the implantation occurs in the entire channel of the '966 patent, not only a section of it, regardless the precision or not of Fig. 1.

- B) The applicant further submits that the rejection is based on a number of false premises. Specifically, the rejection:
 - 1) mischaracterizes element #6 of the '966 patent, and
 - 2) further mischaracterizes element #6 as also showing the region of the implantation.

A) The Applicant's assertions

A1) Fig. 1 of the '966 patent is drawn imprecisely.

Fig. 1 of the '966 patent is reproduced below, along with some additional annotation by the Applicant.



The Applicant repeats that Fig. 1 of the '966 patent is drawn imprecisely. That maybe due to sloppiness, resulting from the fact that it is common knowledge where the channel region would be in this device.

A region 14 should be a gate 14. The Examiners calls it so, and the Applicant agrees. (Reference numeral 14 is nowhere given in the text of the patent, as required by the rules. That may be due to imprecise drafting.)

It will be seen that the footprint of gate 14 does not cover source 11 or drain 12. (In fact, it even excludes two spaces, 6A, 6B.) That can not be right. If it were, such a transistor could not be operated regularly – any person skilled in the art would know that. Yet the patent gives no discussion about any irregularity in this regard.

For example, if the drawing were drawn precisely, V_{th} must be varied according to the lengths of spaces 6A, 6B. However, that would be inconsistent with the patentee's assertion that the V_{th} is controlled instead by the concentration of the p-type impurity into the channel region. In other words, there would have to be an additional control factor of V_{th} . None is mentioned. And in any event, if the lengths of spaces 6A, 6B becomes too large, then V_{th} is no longer controlled at all by the impurity concentration.

A first possible correction might be to draw source 11 and drain 12 larger, extending towards each other, so that they might be under the footprint of gate 14. If that would be the case, spaces 6A, 6B would be eliminated, and a line demarcating region 6 would extend from source 11 and drain 12.

The channel region is an area extending from source 11 and drain 12. The '966 patent does not discuss "sectors" of its channel region. That is the Applicant's verbiage.

The '966 patent refers to "a channel region 6" in numerous places, and with no contradiction. Fig. 1 also shows a dashed line 6, extending substantially from a p-type source region 11 to a p-type drain region 12.

The applicant asserts that, from the text of the patent, channel region 6 is the whole area extending from source 11 and drain 12. While dashed line 6 does not seem to reach exactly these areas, it would, had it been drawn properly.

A2) Fig. 1 of the '966 patent does not show where its implantation occurs.

The '966 patent is directed to precisely controlling the threshold voltage of transistor, by lightly implanting impurity ions into a channel region 6 extending from a source region to a drain region. See col. 2, lines 5-29 and col. 2, lines 58-59.

In other words, dopants are introduced into the channel region between the source and drain of the transistor. The introduction of dopants is accomplished by masking all other transistors and exposing the unmasked gate insulator and underlying channel. See col. 2, lines 10-17 and col. 6, lines 2-10.

Fig. 1 of the '966 patent does not show where implantation occurs. Profiles of the doping are shown in Fig. 2A, Fig. 2B, but those are in the vertical direction. (The sectors of the present invention are in the horizontal direction.)

The only feature that Fig. 1 shows between source 11 and drain 12 is a region 6, demarcated by the dashed line. But region 6 is called "a channel region 6", not an implantation region.

A3) The implantation occurs in the entire channel of the '966 patent, not only a section of it, regardless of precision or not of Fig. 1.

The methods suggested and described in the '966 patent are consistent with introducing dopants into the whole channel region 6.

Indeed, independent claim 1 of the '966 patent recites:

"1. A method ... including the steps of:

- a. doping ... to form source and drain regions ...;
- b. forming an insulating layer between said source and drain regions ...
- c. introducing ... dopants into the gate and channel region between source and drain ... through said insulating layer by masking other devices and exposing each unmasked insulator and underlying channel to an energetic ion beam ... “

In the claim above, the insulating layer is layer 15 of Fig. 1. Layer 15 is an insulator which, as per claim 1, is exposed along with its underlying channel to an energetic ion beam.

As can be seen in Fig. 1, the area under *layer 15* includes the *entire* area between source 11 and drain 12. This includes spaces 6A, 6B of Fig. 1, as reproduced in the present document. That is not contradicted anywhere in the prior art reference. And that is true whether Fig. 1 is drawn precisely or not.

B) The false premises of the rejection.

B1) The rejection mischaracterizes element #6 of the ‘966 patent.

The channel region is the entire area between source and drain. It is continuous between them, because conduction would have to be in a continuous region, to form a current path. Any less than the whole channel region would be discontinuous.

The rejection treats the region demarcated “6” as only a portion (a “sector”) of the channel region. The demarcated portion of the channel region is characterized in the Office Action as “a sector”.

The characterization is respectfully traversed.

Nowhere is *a sector* described in *MacDougall*. That is the Applicant’s verbiage. The patentee in numerous places uses the words “channel region 6” consistently and in numerous places.

The rejection may only rely on the above described imprecision in drafting Fig. 1. The imprecision is exploited to extract the interpretation that element 6 extends along only a portion of the channel. Further, what is consistently called “channel region 6” in the patent is effectively called “a sector 6 of the whole (otherwise unmarked) channel region” by the rejection. That is taken out of context. There is no indication in the ‘966 patent that the dotted line is the range of the first sector in the direction of the channel width. It appears that it merely indicates the existence of the channel region, perhaps its depth, but certainly not its extent in any direction.

Reference number 6 rather refers to a whole channel region, not just a portion of the channel region, as claimed in the invention. MacDougall's channel is described as extending all the way between the source and drain regions. If MacDougall had meant to characterize the channel's true shape and extent, he would have used something other than a dotted line.

B2) The rejection further mischaracterizes element #6 as showing also the region of the implantation.

In paragraph 6 of the Office Action, the rejection suggests that the actually demarcated area 6 also shows the region of the implantation, effectively excluding corresponding regions in spaces 6A, 6B.

Such is respectfully traversed.

As seen above, Fig. 1 of the '966 patent does not show independently the area of the implantation.

As per the above discussion of claim 1 of the '966 patent, the region of the implantation is the entire area under *insulating layer 15*. This includes corresponding regions in spaces 6A, 6B. And that is whether Fig. 1 is drawn correctly or not.

Nor would this be the intent of MacDougall. if the ion implantation is performed to form a first sector of the channel region having a *second* conductivity type, and if the channel region *exclusive* of the first sector has a uniform doping concentration of the *first* conductivity type, the threshold voltage cannot be precisely controlled, as MacDougall purports to attempt.

In this regard, the rejection makes arguments such as: "introducing dopants into the gate and channel region ... does not mean ... the whole channel region." (Paragraph 4 of the Office Action.)

Such is traversed. It is not taught by the prior art, but only generated by the examiner. It effectively expands the scope of the prior art reference. The rejection, however, must use what the prior art actually teaches.

For another example, in paragraph 5, the rejection recites that "some boron implantation would occur in the source/drain regions. MacDougall et al. do not disclose further implanting in the source/drain regions."

That is also traversed. It is misleading, as it is being used to suggest that a process does not happen, because one of its insignificant and well understood byproducts is not *also* mentioned as happening. (The source/drain regions may also be implanted; but that would be

at a lower concentration. Implanting them therefore does not affect them, or the resulting device.)

CONCLUSION

Therefore, MacDougall, when fairly read without the benefit of the Applicant's specification, does not teach or suggest the first sector not reaching either one of the source and drain region and being separated therefrom by equal distances *and* a channel region *exclusive* of the first sector having a uniform doping concentration of the *first* conductivity type with the first sector being of the *second* conductivity type.

Thus, claim 5 is allowable and claims 6-7 and 9, which depend therefrom are also allowable. As such, it is respectfully requested that this rejection be withdrawn.

The Applicant respectfully submits that this application is in condition for allowance, or in perfected condition for Appeal.

The Examiner is encouraged to telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.

Respectfully submitted,

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